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# CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 6 May 2003 with an application for Letters Patent number 525693 made by JASON BREGMEN; COLIN RADFORD and JOEL RADFORD.



Dated 10 June 2004.



Neville Harris
Commissioner of Patents, Trade Marks and Designs

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525693

NEW ZEALAND PATENTS ACT 1953

**PROVISIONAL SPECIFICATION**

IMPROVEMENTS RELATIING TO BILLBOARDS

We, JASON BREGMEN, a New Zealand citizen of 20 Chadway Avenue, Hoppers Crossing, Melbourne 3029, Australia; COLIN RADFORD, a New Zealand citizen of 2/23 Locknway Place, Huntsbury, Christchurch 8002, New Zealand and JOEL RADFORD, a New Zealand citizen of 6 Richards Road, Suva, Fiji, do hereby declare this invention to be described in the following statement:

# IMPROVEMENTS RELATING TO BILLBOARDS

## FIELD OF THE INVENTION

The present invention relates to a billboard for displaying 3D.

## BACKGROUND OF THE INVENTION

3D, animation and flip technology is currently implemented using a lenticular lens disposed in front of an interlaced image print. US 5,847,808 provides a general indication of the technology. The print is created using software that takes "slices" or "strips" of several images and interlaces them using an offset press or a digital printer. The print is applied directly to the back of the lenticular lens, such that the interlaced portions are aligned with the lenticles of the lens. The lenticular lens obscures a subset of the interlaced strips when viewed from a particular angle, such that a composite image is seen, comprising strips originating from one or more of the interlaced images. As the viewer angles shifts, other strips are obscured presenting another composite image to the viewer.

Where the print comprises strips from multiple images of different layers of an object, a 3D effect is achieved. In this context, 3D means the viewer perceives that the image has depth, when viewed at various angles. Flip and animation technology operates in a similar manner, wherein several interlaced sequential images are provided on the print, and the viewer sees each in sequence as they view at different angles. This produces the perception of animation-or flipping, if only two images are used. A similar affect can be produced using a barrier, instead of a lenticular lens, such as shown in US 5,695,346 and US 4,927,238. In this case, the black barrier lines obscure certain portions of the interlaced print at particular angles.

While existing technology can be used to display billboard sized 3D images, animations and flips, it is a relatively difficult and costly exercise due to the limitations of the

technology. For example, the largest lenticular lens available is 2.5m by 1.2m. Therefore, to provide a billboard sized display, multiple lens and prints must be combined.

## SUMMARY OF THE INVENTION

It is an object of the invention to provide an apparatus that can display billboard sized images that are perceived as 3D.

In one aspect the present invention may be said to consist in an apparatus for displaying images including: an enclosure, a frame installed in the enclosure and adapted to hold an interlaced print, and an optical barrier spaced from the frame and adapted to obscure portions of an installed interlaced print.

Preferably, the apparatus further includes a print installed in the frame. The print is a composition of multiple interlaced images applied to a light transparent material.

Preferably the print is produced on a single piece of material.

Preferably, the interlaced images in conjunction with the optical barrier display 3D images to a viewer.

Preferably, the barrier includes a plurality of elongated grills. The grills may be extruded from a non-reflective material, such as anodised aluminium. Preferably, the grills have a triangular or circular segment cross-section.

Preferably, the grills are arranged adjacently in a linear array, oriented vertically, with a gap between adjacent grills. Preferably, the grills are spaced such that there is a ratio of 80/20 of grill width to gap. Most preferably, the width of each grill is 20.32 mm wide, and the gap between each grill is 5.08 mm wide to provide viewing between the angles of 15-65°.

Preferably, the enclosure is adapted to house a light source to provide back lighting for a print installed in the frame. The light source may be a plurality of fluorescent lights, for example. Preferably the enclosure is constructed from non-reflective, opaque material.

Preferably, the space between the print frame and optical barrier is adjustable, either manually or automatically. This may be by way of a suitable mechanical or electromechanical adjustment system, such as telescopic or slidable spacers. This can alter the perceived depth of a displayed image, and/or ensure the desired optical effect is achieved by the apparatus.

Preferably, the relative horizontal and vertical position of the print frame and optical barrier is adjustable, either manually or automatically. This may be by way of a suitable mechanical or electromechanical adjustment system. This may be to align the interlaced print with the grills of the barrier, and/or ensure the desired optical effect is achieved by the apparatus.

Preferably the enclosure can be tilted to provide optimum viewing.

## BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will be described with reference to the accompanying drawings, of which:

Figure 1 shows a preferred embodiment of an assembled billboard for displaying images according to the invention,

Figure 2 shows and exploded view of the billboard, including a print frame and optical barrier,

Figure 3 shows a cross-sectional view of the billboard viewed from point A in Figure 1,

Figure 4 shows a cross-sectional view of the billboard viewed from point B in Figure 1,

Figure 5 shows the optical barrier in relation to the print in more detail,

Figures 6a-6d show an example of a interlaced print in relation to the optical barrier, and

Figure 7 shows an alternative embodiment of the billboard.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a preferred embodiment of a billboard 10 according to the invention in assembled form. The term "billboard" is used throughout the specification to refer to a structure which displays an image. While the structure of the present invention is not a billboard in the traditional sense, it can be used to display images of a size and nature typically displayed by traditional billboards. For example, it can display images which are 6m by 3m or bigger in size. In the preferred embodiment, the billboard 10 is adapted to display 3D images. The billboard 10 includes an opaque enclosure 11, constructed from a base (not visible in Figure 1) and four sides. An optical barrier 12 covers the enclosure 11. Preferably the optical barrier 12 is formed by a plurality of opaque grills, e.g. 14, supported in a rectangular frame 15. The structure 10 forms a light box which substantially restricts light entering or escaping. Typical overall dimensions of a billboard are 6.5 m x 3.5 m with greater sizes generally seeing a disproportionate increase in the longitudinal dimension.

Figures 2 to 4 show internal components of the billboard 10. A print frame 20, adapted to hold a print 21, is disposed in the interior 22 of the enclosure 11. Preferably, the frame is constructed of steel or similar, and has a non-reflective border with a width of approximately 10% to 20% of the length of the print 21, to enhance viewing. The print 21 is a composition of multiple interlaced images applied to a single piece of suitable light transparent print material, such as specified backlit canvas or the like. The print 21 can be stretched over and installed on the frame 20, and a mechanical tension locking system (not shown) holds the print 21 taut. The print frame 20 is spaced from the back wall 23 of the enclosure 11 by four spacer rods, of which three 24a-24c are visible in Figure 2. The spacer rods 24a-24c are interconnected between the frame 20 and the back wall 23 of enclosure 11 by any suitable means known in the art. The optical barrier 12 is attached to and spaced 28 apart from the print frame 20, by four spacer rods, of which 25a-25c are visible. The interior 23 of the enclosure 11 behind the print frame 20 houses a suitable light source (visible in Figures 3 and 4) to back light the print 21. The light source could be, for example, an array of fluorescent lights 30 as shown in Figures 3 and 4. Illuminating the print 21 in this manner, enables the printed image to be viewed through the optical barrier 12. An overhang 27 provides some shielding of the front of the enclosure from ambient light to improve viewing conditions. Preferably, the entire structure can be tilted to optimise viewing.

Figures 4 and 5 show the optical barrier 12 in further detail. The barrier 12 includes a plurality of elongated grills, e.g. 14, with a triangular or circular segmented cross-section. For example, the front face of each grill is flat or curved, and the back is angled. The grills 14 are arranged in a linear array, each extending vertically from the top of the frame 15 to the bottom. The frame 15 is preferably non-reflective and has a width of approximately 200mm to 300mm to enhance the displayed image. Each grill 14 is constructed from stiff non-reflective material, such as anodized aluminum extrusion. The non-reflective qualities reduce reflection of ambient light during the day, which hampers visibility of the print 21. The adjacent grills 14 are arranged to provide a gap 50 between each, through which portions of the print 21 can be viewed by a passer-by. Preferably, there is a 80/20 grill

width to spacing 50 ratio, although a variance of up to 5% can be tolerated. For example, in the preferred embodiment each grill 14 has a width of 20.23 mm and the gap 50 between each grill is 5.08 mm. As will be appreciated, other dimensions that retain the 80/20 ratio of grill width to space 50 could be used. As can be seen in Figure 5, the triangle rear portion of each grill 14, enables a passer by to view the print over a 150° field view.

Figures 6a to 6d show an example of an interlaced print 21 according to the invention. The print 21 is shown in both elevation and plan to illustrate its relationship with the optical barrier 12. Each image forming the print 21 is divided into pixel strips, e.g. 60. The first strip from each image is arranged adjacently in the print 21, and this forms one "set". For example, where ten images form the interlaced print 21, each set comprises 10 strips, one from each image. The second set is formed from the second strip of each of the 10 images, and arranged adjacently to the first set. This process is carried out for the third and subsequent sets, resulting in an entire print 21 assembled from adjacently placed sets of image slices. One set 61 from the print 21 can be seen in Figure 6a. The width of the set 61 matches the width of one grill 14 plus the gap 50 to an adjacent grill. For the preferred embodiment, this width is 25.4 mm or 1 inch. Each of the 10 strips forming the set 61 have a width that is one tenth of this total, namely 2.54 mm. All the sets 61 should be aligned with corresponding grills 14. If they are not, as shown in Figure 6b, the relative positions of the barrier 12 and print 21 should be adjusted from an unaligned position 62, to an aligned position 63.

As will be appreciated, a different number of images may form the interlaced print 21, which will result in a different number of strips forming each set 61. For example, any number between 10 and 25 images may be used in a print 21, resulting in a corresponding number of slices per set 61. In each case, the total set 61 width will match the width of a grill 14 plus gap 50, and therefore the width of individual strips must be adjusted accordingly. Where the billboard 11 displays objects in 3D, each image forming the print 21 relates to a different layer of the 3D objects. Where the billboard displays animations or

flips, each image in the print 21 relates to one image in the animation/flip sequence. The interlaced print 21 could be created from individual images using interlacing software.

Various additional features can be implemented in the basic billboard 10. The print frame 20 and optical barrier 12 could be connected by adjustable spacers 24a-24c to facilitate adjustment of the gap 28. For example, the spacer rods 24a-24c may be telescopic or slidable, such that they can manually or automatically extended or retracted to adjust the gap. Alternatively, any other suitable manual or automatic mechanical or electromechanical adjustment system could be installed. Similarly, the vertical and horizontal position of the print frame 20 and/or barrier 12, could be adjusted by a manual or electromechanical means to align the print 21 correctly with the grills 14 of the optical barrier 12. Correct alignment between the sets 61 of the print 21 and grills 14 of the optical barrier 12 is important to ensure the desired optical effect is achieved. Deliberate movement of the print 21 and/or barrier 12, can however create a desirable animation effect. Preferably, lateral movement is no greater than the width of a grill 14. For example, one option is to use an electric motor to adjust the print laterally and/or horizontally by up to 20mm-30mm.

The print material itself may stretch somewhat when installed on the print frame 20 depending on the particular properties and composition of the print material and the anticipated ambient conditions. It may be necessary to assess this stretch in both the longitudinal and transverse directions and compensate for it, to ensure correct alignment. A mathematical stretch analysis of the print medium can be carried out, and this analysis is used when producing the print 21 to ensure stretch of the material is taken into account and the resultant interlacings are correctly proportioned within the permissible tolerances. The printing process preferably uses a higher resolution than standard billboard printing, and the amount of ink printed onto the material is doubled in density to make it light durable, and to avoid colour blowout.

A displayed 3D image may have an apparent depth of between 60%-100% of the billboard width, depending on the images used and background layer of the print 21. This is a perceived depth, not actual, and may differ from person to person. The perceived depth of a 3D image displayed by the billboard 10 can be changed by altering the distance 28 between the optical barrier 12 and print 21. Altering the gap 28 also ensures the correct optical effect is achieved. The distance 28 between the frame 20 and barrier 12 is calculated to give the desired image clarity, 3D effect, and depth of image. For example, as shown in Figure 6c, there is a wider viewing angle 65 when the gap 28 between the optical barrier 12 and print 21 is increased by moving the barrier 12 from position A to position B. This is due to the increased angles of line of sight 66 from the viewer's eye 67, through the gaps in the barrier 12, to the print 21. As a result, different subsets of the strips 60 are view, and the viewer 67 perceives a greater depth in the displayed image. As shown in Figure 6d, if the barrier 12 is moved closer to the print 21, from position B to position A, there is a narrower viewing angle 69, due to the decreased angles of line of sight 70. Different slices of the images making up the print 21 are blocked, than in Figure 6c. Those slices seen by the viewer form a composite image, which has a shallower depth than for the image viewed in Figure 6c. Similarly, as the viewer moves laterally in front of the optical barrier 12, the angle of their lines of sight through the barrier 12 also changes. This results in a different subset of strips in each set being obscured by the barrier 12, causing the viewer to see a different composite image formed from the strips. In the case of a 3D print 21, the viewer will perceive that they are viewing the displayed image at different angles, when moving laterally.

Figure 7 shows an alternative embodiment of the enclosure holding a print and grid.

Various additional features can optionally be implemented with the invention. The frame 20 can be unlocked and moved back, for example by 500mmm, to permit access to change the print 21 or conduct maintenance or the like. Components of the structure 10 are preferably constructed from materials with similar thermal expansion co-efficients to reduce uneven expansion. Doors and access ways can be included in the billboard 10 to

facilitate maintenance and changing of prints. Sensors to detect temperature, humidity and light remotely could be installed to monitor conditions. Drainage facilities in the billboard could be included. Additional lighting could be included in the billboard to accentuate the image and ensure adequate light distribution.

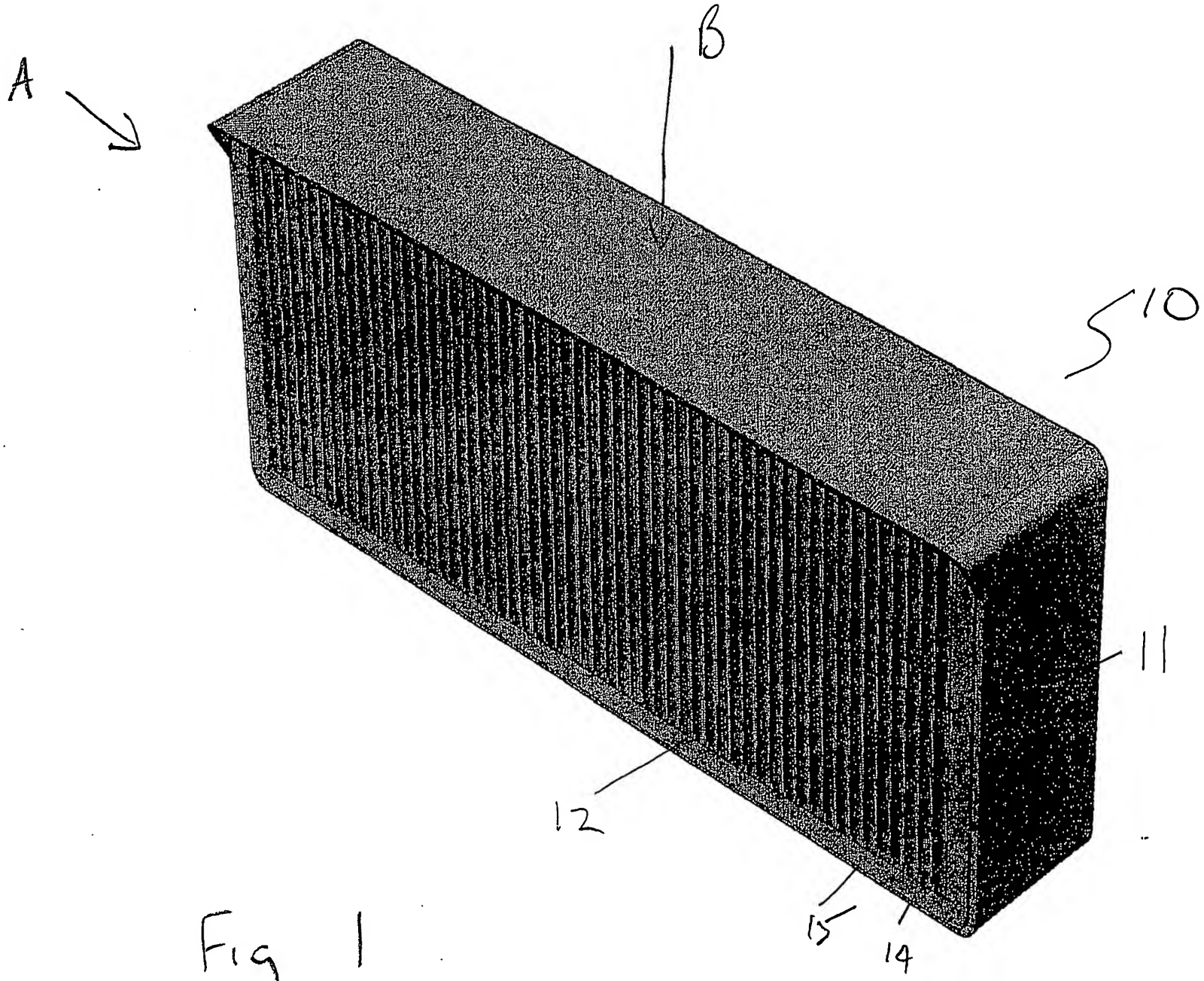



Fig 1

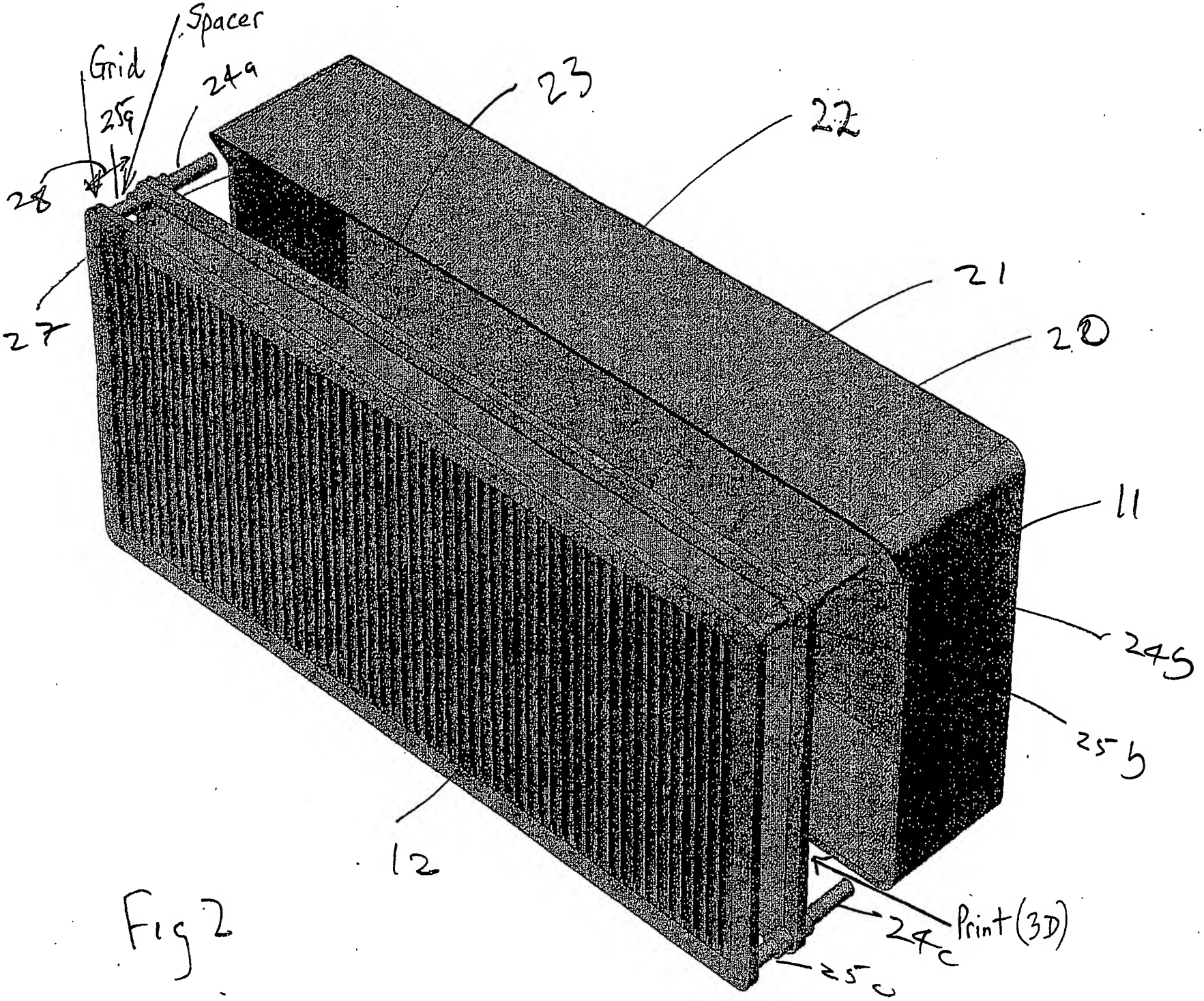

Spacer
Grid
24a
23
22
28
25a
27
21
20
11
24b
25b
12
24c
Print(3D)
25c

Fig 2

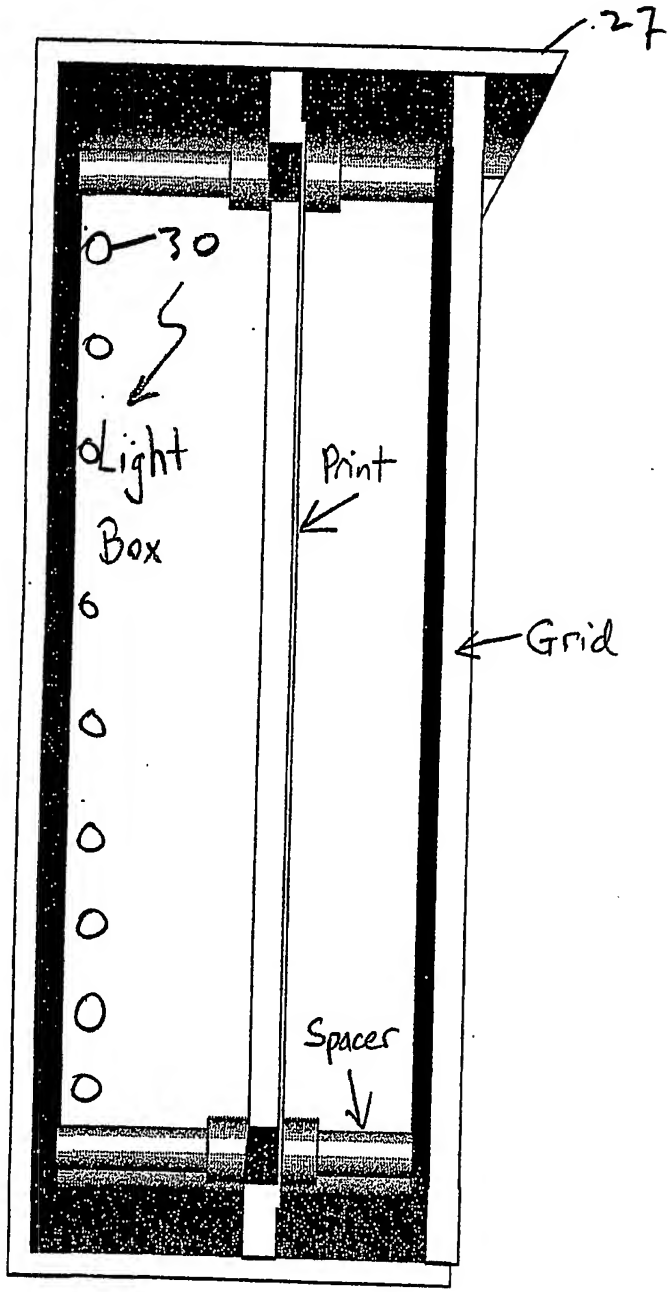



Fig 3

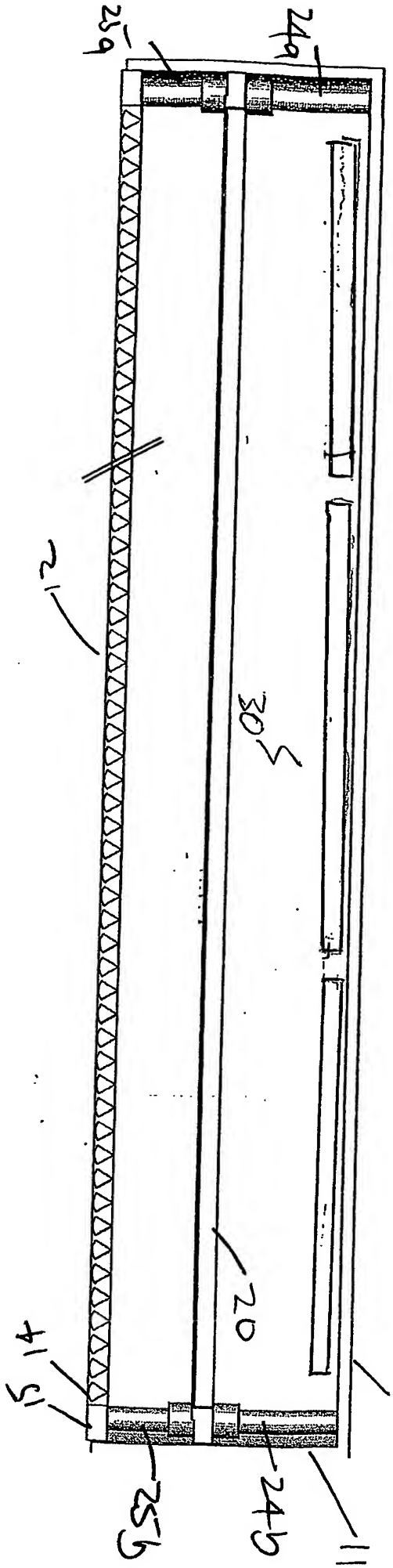



Fig 4

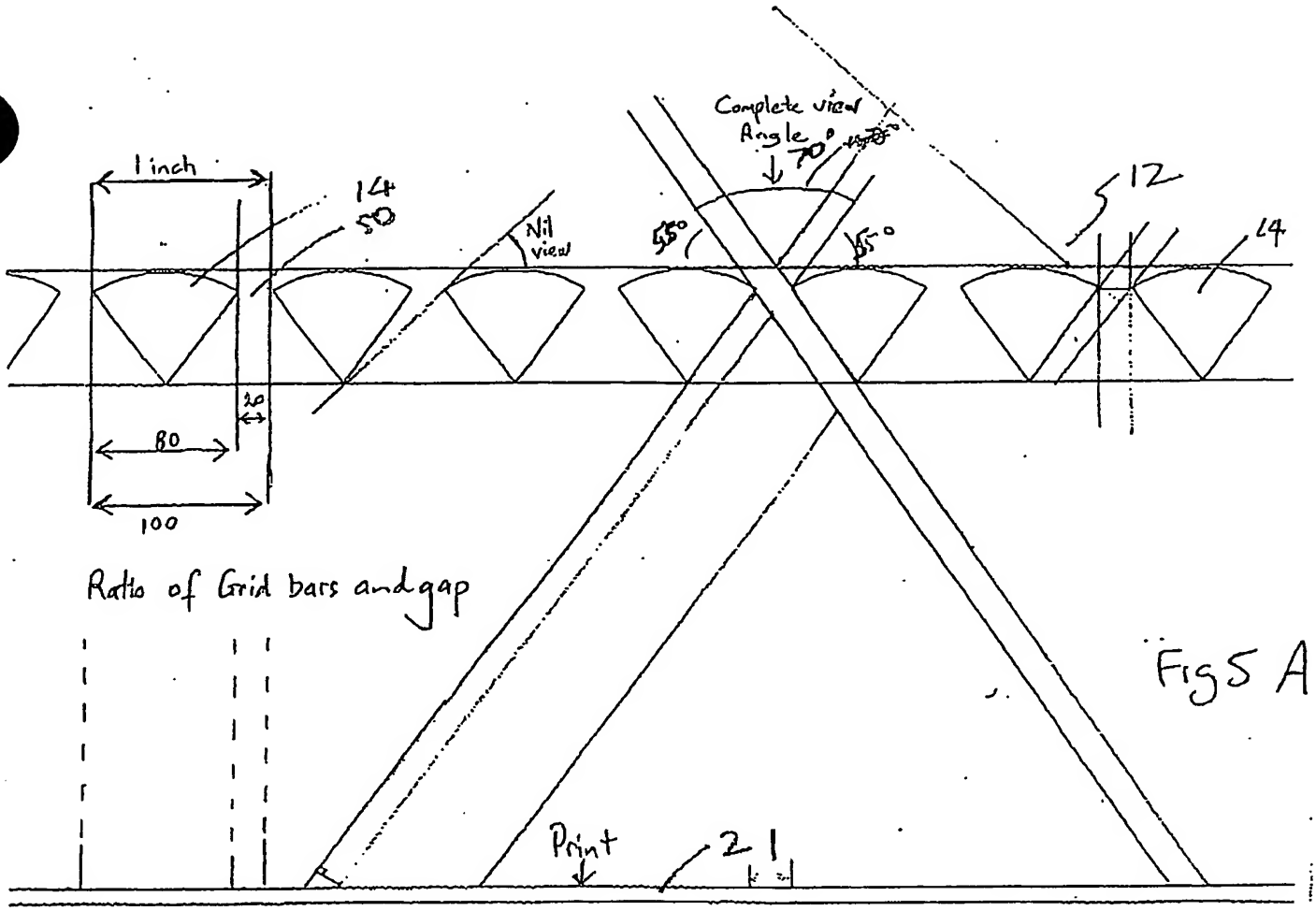

1 inch
14
50
Nil view
55°
Complete view Angle 70°
55°
12
14
20
80
100
Ratio of Grid bars and gap
Print
21

Fig 5 A

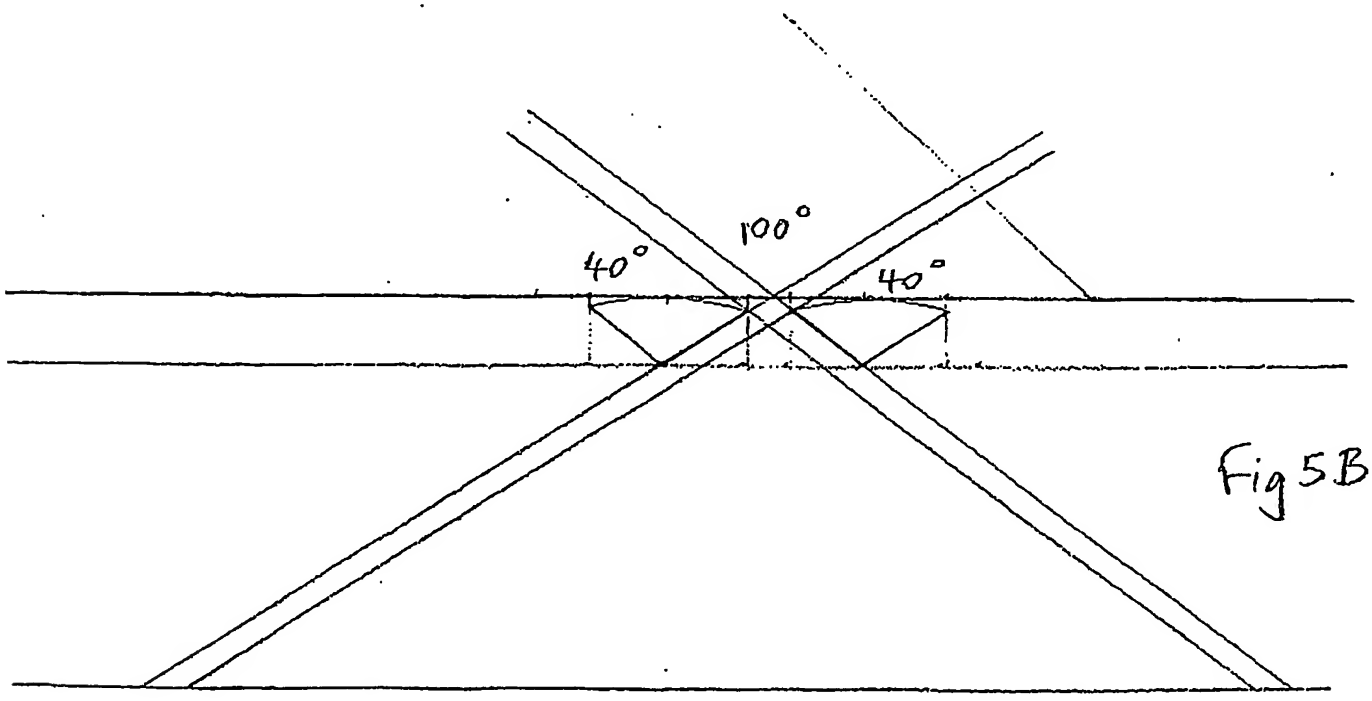
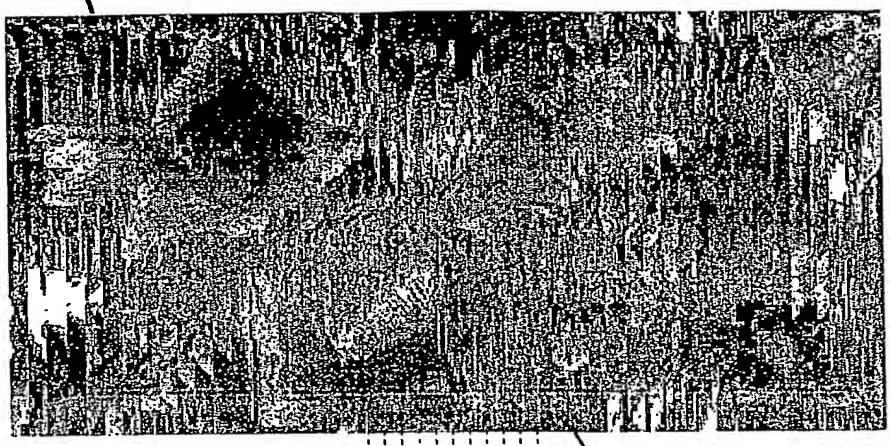

100°
40°
40°

Fig 5B

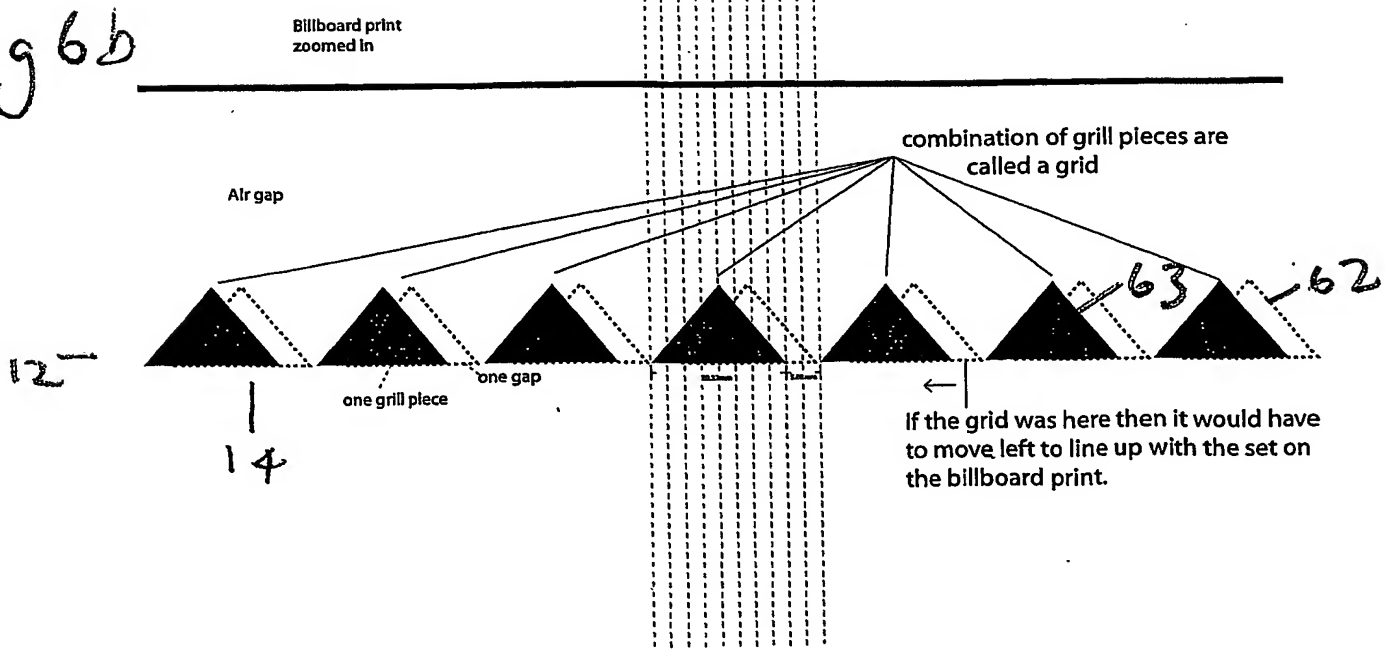
A.

Fig 6a



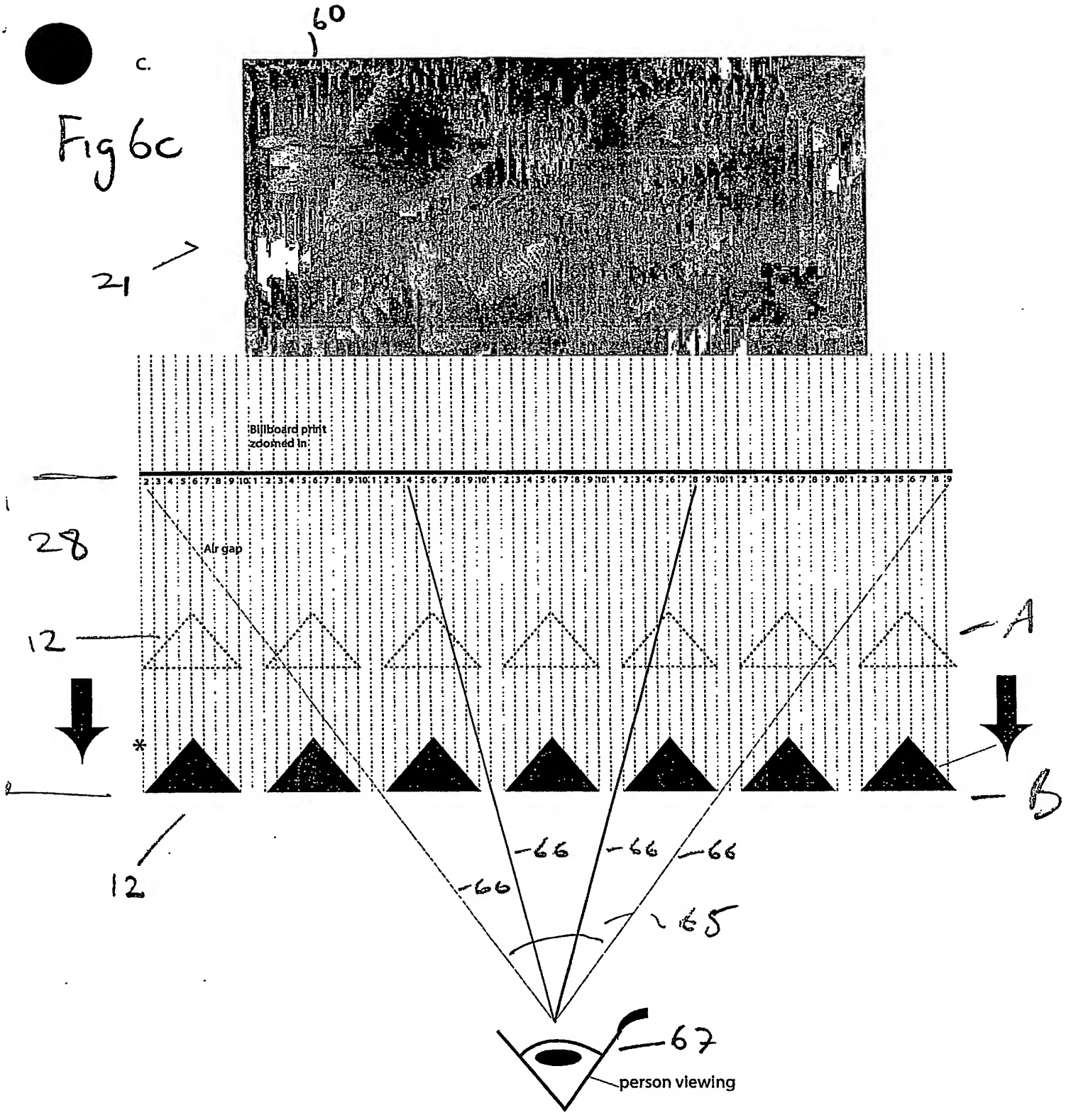

B.

Fig 6b



C.

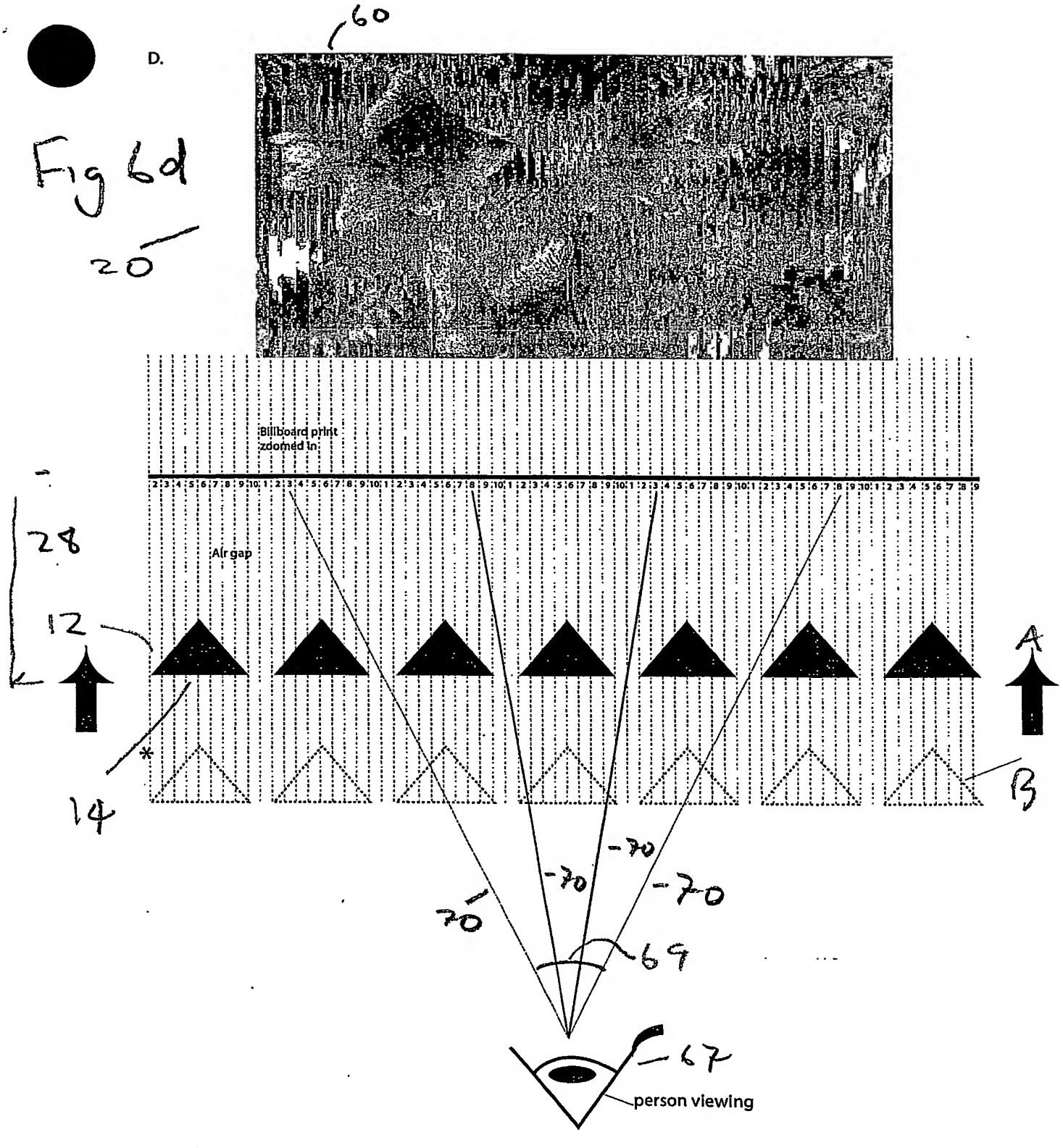
Fig 6c




* the grid can be moved forward or backward, towards or away from the billboard printed image. Notice how in C. where the grill is moved further back the viewing angle has changed as can be seen by the numbers. (Compare numbers with D.) In reality what happens is the perception of depth gets greater, in other words the image appears deeper and may also have greater movement left and right.

D.

Fig 6d




* the grid can be moved forward or backward, towards or away from the billboard printed image. Notice how in D. where the grill is moved forward the viewing angle has changed as can be seen by the numbers. (Compare numbers with C.) In reality what happens is the perception of depth gets smaller, in other words the image appears shallower and may also have less movement left and right.

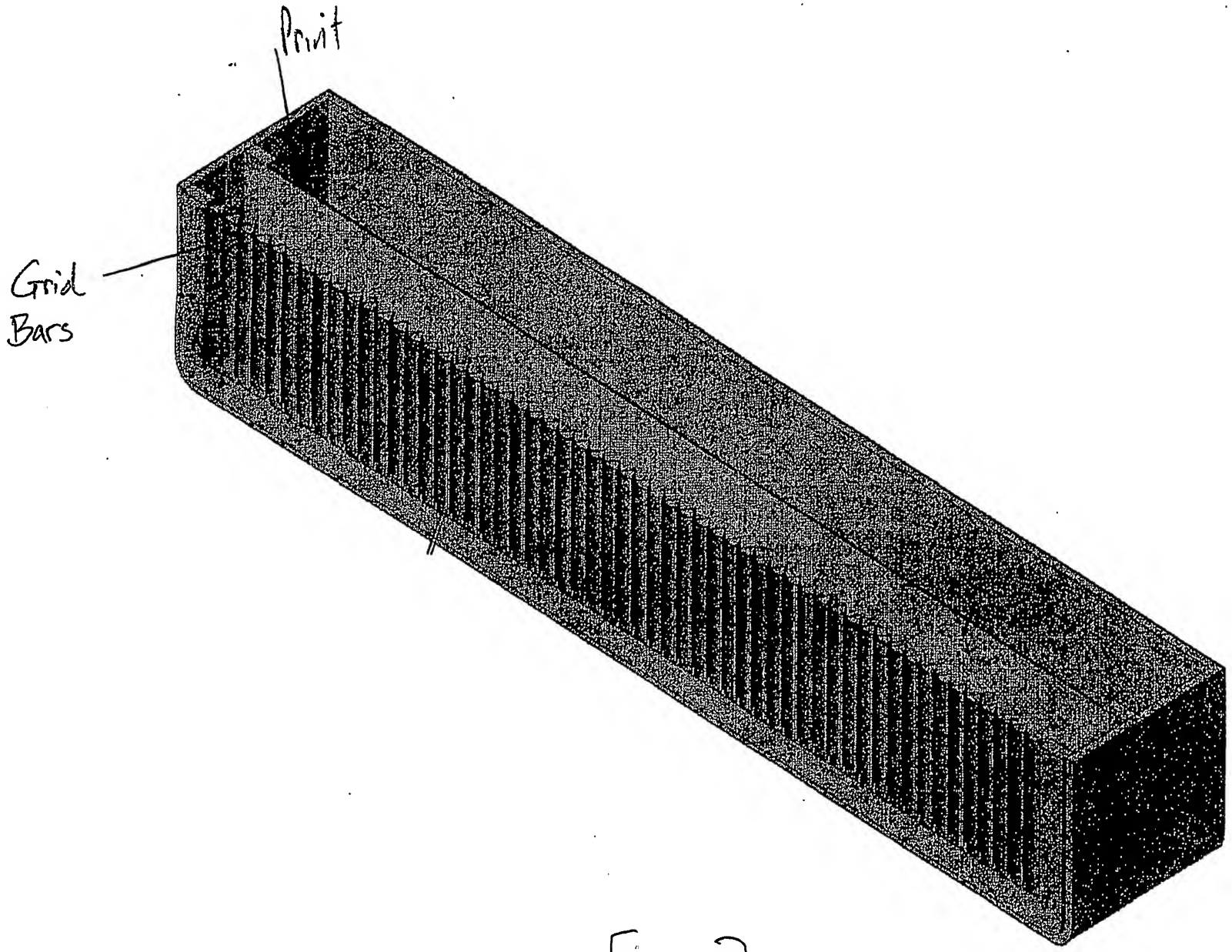



Fig 7

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